Springtails (Apterygota, Collembola) as index of forest site development

A.J. CZARNECKI
University of Nicolaus Copernicus
Department of Animal Ecology
Ul. Gagarina 9, PL-87 100 Torun (POLAND)

In order to reveal the differences and tendencies in the development of forest sites, I used Collembola as bioindexes. These insects show a fair amount of differentiation as regards their functions. The present studies, based on biomasses and the number of species, have revealed differences between the springtail community in forests in Laska and that in Las Piwnicki, depending on the development degree of each of these ecosystems. Namely, in Las Piwnicki with richer sites there occurred many more Collembola species and their biomass was twice, and their number even three times as large as in the degraded pine forests in Laska.

It is more difficult to point out the functional differences among sites within one ecosystem. It appears that the biomass and the number of species are of less comparative value in this respect (Table I). These differences, however, have become more apparent, when more detailed functional characteristics of Collembola have been taken into account. The assessment of the biomasses of these insects in their particular ecological groups in Las Piwnicki has demonstrated that in the pine forest they take a greater part than in the deciduous forest in transporting organic matter down the soil. In the deciduous forest, on the other hand, there are more Collembola participating in the mineralization of matter.

TABLE I

Mean density and biomass of Collembola in the forest sites.

Sites / Para-meters	Las Piwnicki		Laska			
	mixed pine forest	leafy forest	dry pine forest		fresh pine forest	wet pine forest
			with lichens	with blueberry		
density (ind. m^{-2})	75039	90507	31158	33871	14959	34384
biomass (mg . m^{-2})	616.6	598.9	352.1	375.7	141.1	363.8
soil springtails						
small	10.8	13.8	17.0	19.6	20.4	13.6
medium (size)	94.9	144.3	95.2	103.7	25.5	20.4
mobile springtails	495.3	410.3	249.9	241.4	304.5	80.2
sucking up liquid springtails	56.8	3.6	36.2	4.3	10.2	17.7

In Laska, in all the pine sites studied, the percentage of mineralizing species was low. Except for the fresh pine forest, there were more Collembola participating in introducing organic matter into the soil. In wet pine forest more numerous were populations of species sucking liquids out of mycelia and the hard parts of plants. It is interesting to note that in Bory Tucholskie the soil species were about as abundant as in Las Piwnicki, whereas the more mobile species were much less abundant. This is often reflected in low intensity of soil forming processes, e.g. in wet pine forest. At present, in Laska it is not the fresh pine forest but the dry pine forest with lichens that is in equilibrium with the site. In Las Piwnicki, on the other hand, both the deciduous forest and the mixed forest are in equilibrium with the site.

In each ecosystem the mechanisms stabilizing the above processes operate with different efficiencies. To understand the role of Collembola in this respect it is necessary to know their efficiency in adapting themselves to seasonally changing life conditions, for it is on efficiency in adapting themselves to seasonally changing life conditions, for it is on the efficiency with they restore the numbers of their community that depends the rate of utilizing the food basis and, consequently, the rate of organic matter decomposition in the ecosystem.

In forests drastic reduction in the numbers of Collembola is observed during vegetative season. In that time in Las Piwnicki the lowest density ranges between 10 and 20 thousand per m^2; in the deciduous forests the drops in numbers being smaller than in the pine forest. They are then stable systems and to a large extent independant of the influences of the environment. In Laska, only in the dry pine forest with lichens the drops in numbers are relatively small.

The final conclusion is that in the course of development of sites and biogeocenoses a parallel course of development of the Collembola community is observed, and the chief functions of Collembola reflect the character of phenomena connected with the cycling of elements in the ecosystem under study.

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